

## INVENTION TITLE

A LOCATION-BASED APPARATUS AND METHOD FOR INTERACTIVITY WITH DIGITALLY RENDERED PARTICIPATORY AND EXPERIENTIAL ENVIRONMENT IN REAL-TIME USING WIRELESS COMMUNICATION NETWORK



## DESCRIPTION

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#### CROSS REFERENCE TO RELATED APPLICATION

[Para 1] Not Applicable

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#### STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[Para 2] Not Applicable

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#### THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT

[Para 3] Not applicable

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#### INCORPORATION BY REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC

[Para 4] Not Applicable

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#### BACKGROUND OF THE INVENTION

[Para 5] FIELD OF THE INVENTION

[Para 6] This invention is an operating method and a location-based apparatus to record, process reproduce a participatory and experiential dynamic environment, including three-dimension and holographic environment for a person to perform various activities with the said digitally rendered environment in real-time over wireless communications network including, but not limited to, worldwide interoperable microwave access network, Wireless Wide Area Network, Wireless Broadband, Long term Evolution or 4G or any 802.xxx over the air (the “wireless communication”) network.

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### DESCRIPTION OF RELATED ART

[Para 7] A location-based interactivity in a 3-D (three dimension) display is different from existing stereoscopic image systems, which uses extra equipment such as polarizing eyepiece or uses a lenticular sheet with separate methods for audio and visual inputs therefore create inconsistency between audio and video while interacting with the user.

[Para 8] A location-based interactivity in a 3-D (three dimension) display is different, from DFD method, as discussed in US Patent 7,425,072 entitled “Method and apparatus for displaying 3-D image” where a series of 2-D images are composed of section-images of a 3-D object, are successively displayed at different positions in a depth-direction. However, these images are fixed and not dynamic to create three-dimension environment that is transported from another location using wireless network.

[Para 9] Another example is discussed in US Patent Application 20040067419 entitled “Holographic recording medium”. This document discloses holographic recording medium and, particularly, to a holographic recording medium in which data can be three-dimensionally recorded as a hologram. However, this method uses optical device and therefore does not provide real-time interactivity with the user over wireless communication network.

[Para 10] Another example is discussed in the US Patent 7,471,431 entitled "Hologram device and hologram recording/reproducing method". This document discussed a hologram device records information of an interference fringe of signal light and reference light onto a hologram recording medium and reproduces the recorded information by emitting the reference light onto a recording area of the hologram recording medium. This method is about recording and re-producing data recorded in a hologram device. However, the present invention is advantageous to provide a platform for real-time audio-video interactivity with the three-dimension environment.

[Para 11] Another example is discussed in the US Patent 7,470,028 entitled "Image projection device and method". This document discussed A device for forming an image on a screen is described that comprises a coherent illumination means, an electrically addressed spatial light modulator means located in the path of light from the coherent illumination means, means for producing computer generated hologram images for display on the electrically addressed spatial light modulator means, and optics to direct light diffracted by the electrically addressed spatial light modulator means to the screen.

[Para 12] In essence, the prior inventions are either recording medium, projection system or reproducing apparatus for three-dimension images, The methods like defracted light, optical medium or pixel count are used to record process and reproduce three-dimension images that are capable of processing static images to form three-dimension images or hologram, however this invention has focused on dynamic images using multi-dimensional whole-part method to record, transport and reproduce digital images.

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### SUMMARY OF THE INVENTION

[Para 13] It is therefore an object of the present invention to provide a location-based system (the “apparatus”) for and a method of recording and reproducing participatory, experiential environment including three-dimension, photo-realistic simulation and holograms environment (the “environment”), integrated with audio data and sensor data, used for performing activities over wireless communication network.

[Para 14] To achieve the above object, there is provided in accordance with the present invention an apparatus for reproducing an environment including a recording system for recording a plurality of light beams emitted from one light source in a computing system (the “recording medium”); a reproducing system for reading information recorded in the recording medium that reproduces light beams displayed on a plurality of display systems (the “screens”); a plurality of audio inputs and outputs; a medium control system for synchronizing the recording medium for recording, reproducing a plurality of interference patterns when information is recorded on and reproduced from the recording medium and audio input outputs; and a wireless communication network.

[Para 15] In another aspect this invention is a method of providing fully integrated audio-video communication with response on a stimulus and displaying results as environment in a manner corresponding to the user’s movements and engagements with the physical movements and position using multi-dimensional whole-part pattern. Multi-dimensional whole-part method allows the apparatus to store, transport and re-produce audio, video and sensor information from both performer of the activity (the “user”) and the environment over a wireless communication network. This dynamic environment enhances the experience of the interaction between the user and the environment indicating a communication state.

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### BRIEF DESCRIPTION OF THE DRAWINGS

[Para 16] For the present invention to be clearly understood and readily practiced, the present invention will be described in conjunction with the following figures wherein:

- (1) FIG. 1: The top-view of the apparatus - the location-based system.
- (2) FIG. 2: The inside view of the apparatus according to an embodiment of the present invention
- (3) FIG. 3: A block diagram of the physical structure of an integrated Projection Camera Wall
- (4) FIG 4: is the pictorial illustration of a physical environment reflected in a three-dimensional environment according to the method of the present invention
- (5) FIG 5: is the embodiment for recording and reproducing interactivity
- (6) FIG 6: is the block diagram data flow diagram illustrating signal processing
- (7) FIG 7: is the pictorial illustration of a user interactivity with the environment according to the method of the present invention

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### DETAILED DESCRIPTION OF THE INVENTION

[Para 17] The present invention is, generally speaking, more suitable for deployment in conjunction with the method of storing, processing and creating interactive, participatory experiential (the "IPE") displays that allow users to observe dynamic environment. For reference, we have two actors: a) the person actually performing an activity (the "user") and therefore interacting with the digitally rendered screen in the apparatus; b) an external physical object, illustrated as another person who is physically not present in the apparatus.

[Para 18] A diagrammatic representation of a preferred embodiment of the apparatus in accordance with the invention is shown in FIG. 1. The preferred device (101) has four major components: a) high-speed projector with plurality of 3D digital video camera (102) that move vertically and horizontally to capture dynamic visuals of objects; b) computing equipments (103) including but not limited to computer server, software, processor and memory; c) audio input (104), such as microphone, which is processed and relayed by the computing device (103); d) audio output, such as speakers, which connected, processed and relayed by the computing device; e) a wireless communication network (106).

[Para 19] A more detail view of the apparatus (101) is depicted in FIG 2. wherein all the six sides have high-speed projector with 3D digital video camera (the "projector camera wall") fixed on the wall (102). Since the shape of the apparatus is designed, however not exclusively designed so, as oval-shaped chamber, the projector camera wall (102) covers all aspects of the object in that apparatus to form dynamic images. In the middle of the apparatus, there is a audio-video-sensor processor (the "processor") as a unit (201) to synchronize sound, light and sensor information in order to project the image on the screen (202). The apparatus also has wireless communication network (204) to receive and transmit data to the processor (201) from external sources in order to project on the screen (202). The processor (201) may generally consist of a series of microprocessors, memory, a two-dimensional sensor which obtains two-dimensionally modulated image data, and converters which converts analog data obtained by the light-receiving unit into digital data. The processor in turn communicates with a set of computers and application components (203) that are housed underneath (the "chamber") as one component (206) of the apparatus (101). There are several recording means (205) by which the real-time IPE could be achieved by manipulating and adjusting, focus, exposure and speed of movement of digital camera lenses to capture the state of the object in the apparatus (101). A light receiving controller (the "controller") manipulates various components such as focus, exposure, speed,

directions and communications to control plurality to digital video cameras. The controller in turn communicates with another set of computers and application components that are housed underneath (the “receiving station”) as one component (207) of the apparatus (101).

[Para 20] A more detail view of the physical structure of the projector camera wall is depicted in FIG. 3, wherein there are two components a) projection lens (301) that beams the light on the screen (202) and b) digital video camera lens (302) that receives the light from the object in the apparatus (101). Both lenses flip to one another, which means a single cell has both projection lens and camera lens and when projection lens is active, that cell produces light and when it flips to camera lens the lens receives the light. However, they do not co-exist. The flipping process (the “flip”) between projection lens to camera lens at a very high-speed makes this switch seem-less.

[Para 21] One camera lens is usually active in one track (the “track”) where as rest of the lenses are on projection mode. This active camera lens on the track moves (the “trace”) vertically at a very high speed. This trace is guided by a laser light (304) for recording and reproducing information. The pattern of trace (the “pattern”) is such that a very high speed it appears to be moving both horizontally and vertically. Each camera produces a series of images from every dimension with each image is being comprised of whole image (the whole”) as well as part of the whole image (the “part”). The depth information is further manipulated by the controller (206) to produce dynamic object-centered descriptions of everything within an image. Controller, as a stand-alone system, triggers to synchronously record frames from multiple cameras. The output of each camera is time stamped with a common Vertical Interval Time Code (the “VITC”). The time code allow us to correlate the frames across cameras which is crucial when transcribing movements and triggering effect. The combination of using pattern, multi-dimensional whole and part images from each video camera with VITC (the “light receiving process”) allow the controller to record in a way to form three-dimension dynamic images or holographic images.

[Para 22] The projection lens (301), on the other hand, uses the multi-dimensional whole and part images on a screen comprising: a coherent illumination means; an electrically addressed spatial light modulator (the "EASLM") means configured to diffract light received from the coherent illumination means, wherein the light is received by said EASLM means as a plurality of sequential computer generated images; and optics configured to direct light diffracted by the electrically addressed spatial light modulator means to different areas of the screen to optically build up a whole image of the multi dimensional image over time, wherein each of the plurality of sequential computer generated images is whole and part of the complete image correspond to one of the different areas of the screen (202), thus forming the environment on the screen (202) of the apparatus (101). The top and bottom section of the screen has sensors (303) to capture movement of the user of the apparatus (101).

[Para 23] What follows in FIG. 4, a procedure of communication between the user of the apparatus and the IPE environment on a real-time basis. Any physical object environment (401) located outside the apparatus, that is present at the time or pre-recorded, is captured in identical pattern (404) including audio and sensor output and communicated over the wireless communication network (106) to the apparatus (101), which uses projection lens (301) to send data to its processor (201) and to the screen (202) to overlay message. If the display attribute (403) is for specifying scrolling or moving (synchronized with participant movement) the overlay message is displayed in the environment (402) as a scrolled manner (giving an impression of movement). If the display attribute (403) is for specifying reverse display, flashing, coloring, or display sizing, the overlay message is displayed in the environment (402) as specified within the apparatus.

[Para 24] If the final desired display resolution is  $N$  pixels broken up into  $b$  blocks. Then the controller (207) will process as if each block has  $N/b$  pixels and  $N/b$  computerized projected pixels of each whole picture combined with part of the picture to create the IPE



environment or computerized graphics for hologram pattern. Each block is processed in the processor (201) and illuminated in sequence to build up a frame, hence each frame is fast in order to give the user the whole display as illuminated. If the number of frames produced each second is  $f$  then the number of EASLM frames per second is given by  $f \cdot b$ . This means that the total number of projected pixels that are combined in each second is  $(f \cdot b)^N$ . This result is independent of the block size and suggests that the only way to bypass the computational burden is to run computations in parallel. The field sequential color frame rate is around thousand frames per second, and thus for a ten million pixel image produce  $(1K \cdot 10)^9$  projected pixels must be combined per second to create photo-realistic three-dimensional dynamic images or holographic images.

[Para 25] The recording of the visual data, audio data and sensor data in the apparatus is captured in combination of digital video camera (302) and laser light (304) and audio input (104) as depicted in FIG.3, collectively form a light receiving process (the "light receiving process") as depicted in the FIG. 5. They are trigger the laser scanning screen (504), which is invisible in nature to measure and record the dynamic object from all dimensions (the "multi-dimensional") to form the three-dimensional image. The spatial modulator (501) displays a pattern of white and black pixels obtained by executing a two-dimensional digital modulation of information. The spatial modulator uses the pattern to modulate the light beam. FIG. 5 shows an example of the two-dimensional modulation executed by the spatial modulator. In this example, as shown in FIG. 5, digital input information data (502), that is, information data in "0" and "1" combinations to be recorded on a recording medium (503), is expressed using a combination of white and black pixels. An array of white and black pixels arranged in this order in a vertical direction corresponds to the input information data "0" combinations. An array of black and white pixels arranged in this order in the vertical direction corresponds to the input information data "1" combinations. A laser light

(304) guided by two-dimensional sensor (303) detects a detected light from the recording medium (503) to reproduce the recording information.

[Para 26] Next, description of the formation of IPE environment – recording and reproduction – in the apparatus according to a first embodiment of the present invention.

FIG. 6 is a block diagram schematically showing the configuration of the signal processing system of the IPE, which could be generated by, and not limited to, data base, integration of data, software application, software code, computer, wireless network hardware, etc recording control of the system is through the data glove or equivalent device, and reproduction apparatus according to the first embodiment. The incoming and outgoing data to formulate interactivity between the user and IPE environment, as depicted in the FIG 6, digitized and processed through a wireless communication network.

[Para 27] The process of digitization and synchronizing for IPE environment triggers processor and controller to coordinate, as depicted in FIG. 7, for interactivity. As the interaction with the user and IPE environment changes, the information recorded in the computer triggers the change in the environment and updates the environment following the same process. Referring to FIG 7, an automated protocol management system that may be utilized in the present system of the invention may contain one or more following functions:

[Para 28] the design and editing of protocols for pre-recorded information (the “stand-alone”) use and downloading information to an external device

[Para 29] detail guiding of the user through the process of using the apparatus for interactivity

1. signaling the start and end of the protocol and all required signals for both ends
2. collecting data and recording them in a recording medium

3. uploading data from the “connected” and “stand-alone” apparatus such as database and software to provide information to the user
4. sharing of information between one user to another within the same apparatus
5. providing a GPS and tracking methods for user information
6. providing visual and auditory cues to the users

The methods, apparatus and systems of the invention have broad uses in a wide range of activities and competitive environments. The system not only has applications for using by a single community, but also for workplace, shopping mall, retail, banking and other function performance. Situations that require methodical monitoring and feedback on speed and ability of movement.